CO_2 exchange coefficients from space-borne measurements of wind speed: SSM/I versus QuikSCAT in 2000

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With the ultimate goal of using the 13-year time series of wind speed from the Special Sensing Microwave Imager (SSM/I) to address the interannual variability of the air-sea exchange coefficient for CO_2, K, we present here a comparison of K estimated from SSM/I (K_S) and the scatterometer QuikSCAT (K_Q) for the year 2000. Exchange coefficients estimated from the monthly average fields of wind speed from the two sensors present the same patterns in space and in time, although those estimated from SSM/I are larger for 59-67% of the world ocean. For both sensors, most values (> 50%) fall between 2.5 and $7.5{\cdot}10^{-2}$mol m^{-2}y$^{-1}\mu$atm^{-1}. Over 95% of the K values from the two sensors are within $2{\cdot}10^{-2}$mol m^{-2}y$^{-1}\mu$atm^{-1} and over 80% are within $1{\cdot}10^{-2}$mol m^{-2}y$^{-1}\mu$atm^{-1}. The global mean K_S is between 0.17 and $0.5{\cdot}10^{-2}$mol m^{-2}y$^{-1}\mu$atm^{-1} larger than K_Q for all months, with larger differences in the second half of the year. Likewise, the zonal mean K_S are consistently larger, except between 40°S and 50°S and within 20° of the equator. The global mean flux estimated with the Δp_{CO_2} field of Takahashi (1999) and K_S is between 1.69 and 3.12 Gt C y^{-1}, while the QSCAT estimate ranges between 1.07 and 2.5 Gt C y^{-1}. Differences in global flux estimated from the two sensors are between 0.52 and 0.64 Gt C y^{-1}: the difference is greatest in the Atlantic basin in boreal spring and summer while in the Indian basin, the flux estimated from SSM/I is less than that from QuikSCAT. The difference between K_S and K_Q is largest in areas of negative Δp_{CO_2}, thus leading to an overestimate of the oceanic sink term. The monthly anomaly of K (having subtracted the annual mean value) is of comparable magnitude and range for the two sensors. The rms values of the two monthly anomaly time series are less than $1{\cdot}10^{-2}$mol m^{-2}y$^{-1}\mu$atm^{-1} in 60% of the world ocean. A new monthly K estimate, using the QuikSCAT annual average and the monthly anomaly from SSM/I is a closer approximation (within 0.03 and $0.3{\cdot}10^{-2}$mol m^{-2}y$^{-1}\mu$atm^{-1}) to the QuikSCAT estimate and the corresponding global

flux is within 0.15 and 0.49 Gt C y^{-1}. These comparisons support the use of SSM/I to quantify interannual variability in the air-sea exchange of CO_2.